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Introduction

- Concrete is one of the most frequently used building materials. Mechanical failure of the concrete section is nearly impossible to prevent. However, cracks can be controlled, and strength can be enhanced by appropriate reinforcement.
- The goal is to create a superior class of high-performance concrete using post-cure active prestressing fibers. Initial tests with chitosan polymer from shrimp shells proved concept. Present focus is on steel fibers with prestress release techniques.

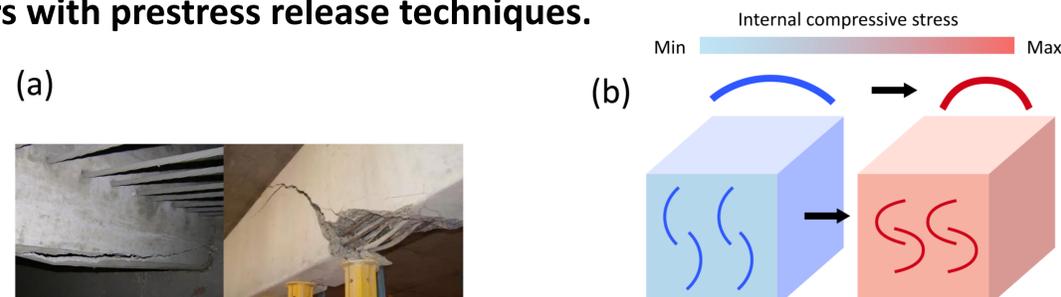


Figure 1. (a) Fracture of unreinforced and reinforced beam structures. (b) Schematic of concrete with post-tensioning shrinking fibers.

Data collection & prestressing design

- Four-point bending tests with a loading span of 80 mm, and supporting span of 240 mm.
- Each test used two constant loading rates, a 100 Hz sampling rate and acoustic emission monitoring.
- Steel rings and steel cotter pins are prestressed with water soluble 3-D printing filament and then put into concrete beams.



Figure 2. (a) 2-D acoustic emission monitoring during a 4-point bending test. (b) Beam specimen before and after fracture. (c) Designed prestressing steel fibers

Results and conclusion

Specimens with two different fiber volume ratios of 0.5% and 1.0% were tested with two different loading rates, 0.03 in/min and 0.15 in/min respectively. Flexural strength of steel fiber reinforced concrete (SFRC) specimen exhibited great strength and ductility.

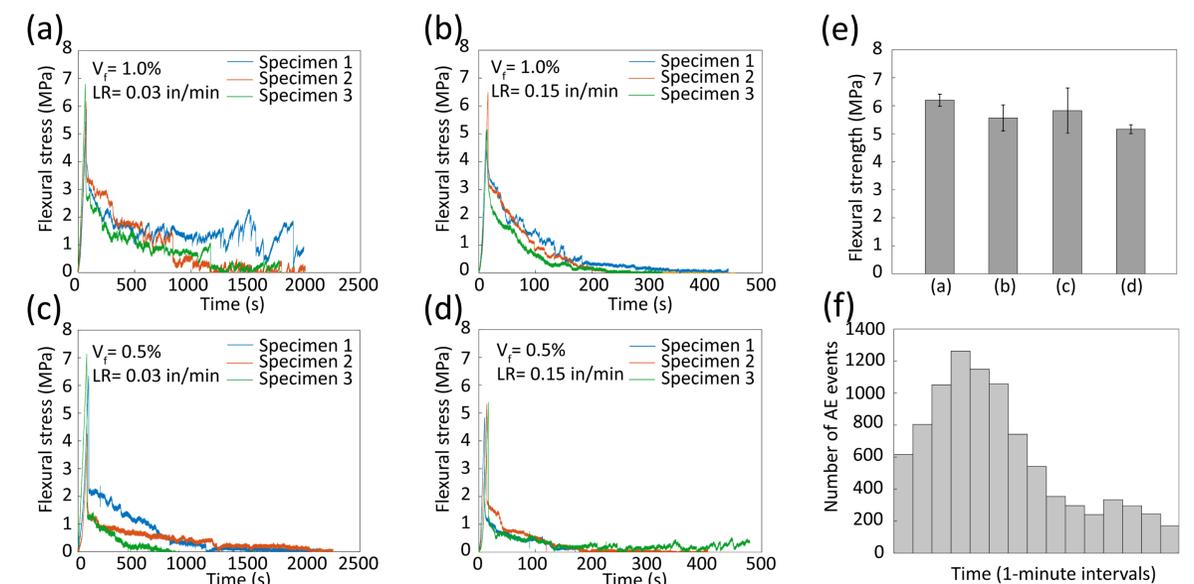


Figure 3. (a)-(d) Stress vs time curve of each testing batch. (e) Summarized flexural strength of each testing batch. (f) Number of AE events of the first 15 minutes.

Future work

Planned future work includes testing of prestressing steel fibers. We will also test the beam specimens with different fiber volume ratios.

Acknowledgments

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References

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